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(11) CA 2 353 350 (13) A1

(40) 20.01.2003
(43) 20.01.2003

(12)

(21) 2 353 350

(51) Int. Cl.[7]: B65D 83/04, B65D 75/54

(22) 20.07.2001

(71) WILSON, ALLAN,
40 McKinnon Road, OTTAWA, O1 (CA).
PETERSEN, MICHAEL,
161 Carleton Street, OTTAWA, O1 (CA).

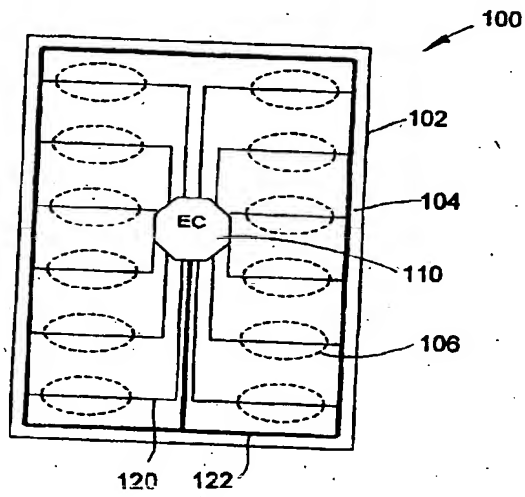
(72) PETERSEN, MICHAEL (CA).
WILSON, ALLAN (CA).

(74) MACRAE & CO.

(54) DISPOSITIF DE CONDITIONNEMENT ET SYSTEME DE DETECTION D'UTILISATION DU CONTENU
(54) PACKAGING DEVICE AND CONTENT USE MONITORING SYSTEM

(57)

A packaging device is provided for monitoring use of packaged contents. The packaging device comprises a package, an electrically conducting path and an electronic chip embedded in the package. The package has one or more sealable receptacles for accommodating contents. The electrically conducting path is connectable to each receptacle. It changes its characteristics when the receptacle is opened after being sealed. The electronic chip monitors the change in the characteristics of the conducting path, and generates content use data when the change in the characteristics of the conducting path is detected.



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CA 2353350 A1 2003/01/20

(21) 2 353 350

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2001/07/20

(41) Mise à la disp. pub./Open to Public Insp.: 2003/01/20

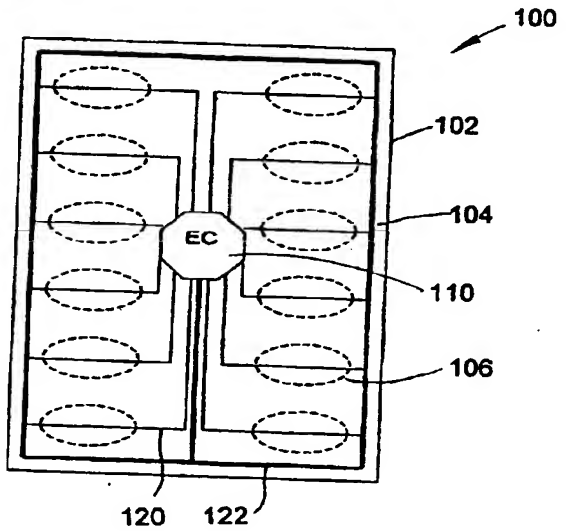
(51) Cl.Int.^{7}/Int.Cl.^{7} B65D 83/04, B65D 75/54

(71) Demandeurs/Applicants:
PETERSEN, MICHAEL, CA;
WILSON, ALLAN, CA

(72) Inventeurs/Inventors:
PETERSEN, MICHAEL, CA;
WILSON, ALLAN, CA

(74) Agent: MACRAE & CO.

(54) Titre : DISPOSITIF DE CONDITIONNEMENT ET SYSTEME DE DETECTION D'UTILISATION DU CONTENU
(54) Title: PACKAGING DEVICE AND CONTENT USE MONITORING SYSTEM



(57) Abrégé/Abstract:
A packaging device is provided for monitoring use of packaged contents. The packaging device comprises a package, an electrically conducting path and an electronic chip embedded in the package. The package has one or more sealable receptacles for accommodating contents. The electrically conducting path is connectable to each receptacle. It changes its characteristics when the receptacle is opened after being sealed. The electronic chip monitors the change in the characteristics of the conducting path, and generates content use data when the change in the characteristics of the conducting path is detected.

ABSTRACT

A packaging device is provided for monitoring use of packaged contents. The packaging device comprises a package, an electrically conducting path and an electronic chip embedded in the package. The package has one or more sealable receptacles for accommodating contents. The electrically conducting path is connectable to each receptacle. It changes its characteristics when the receptacle is opened after being sealed. The electronic chip monitors the change in the characteristics of the conducting path, and generates content use data when the change in the characteristics of the conducting path is detected.

PACKAGING DEVICE AND CONTENT USE MONITORING SYSTEM

This invention relates to a packaging device and a content use monitoring system, and more particularly, to a packaging device and a content use monitoring system that is especially adapted to medication packaging and dispensing.

BACKGROUND OF THE INVENTION

Medications comprise a large component of health care. A limiting factor to the effectiveness of many medications is patient compliance with the prescriptions. Medications usually have to be taken at specific intervals based on their pharmacokinetics to maximize plasma levels, and deviation from the prescribed interval may result in ineffectiveness or adverse effects. As the patient population ages, the incidence of medication errors increases.

Existing devices designed to increase compliance include various mechanical devices designed to indicate the time for taking pills from holders or dispensers. Examples are United States Patent No. 3,410,450 issued to Fortenberry on November 12, 1968 showing a dispenser with a dial indicating the time for pill release, United States Patent No. 3,402,850 issued to Barton et. al. on September 24, 1968 for a tablet dispenser with a day-indicating schedule, and United States Patent No. 3,871,551 issued to Bender on March 18, 2975 showing a pill dispenser with a pill-actuated time readout.

It would also be useful to prescribing physicians and pharmacists to have a record of their patients' compliance with medication.

Existing devices in this area comprise various mechanical devices designed to keep a record of when the medication is dispensed. Examples are United States Patent No. 3,332,575 issued to Pilot July 25, 1967 showing a dispenser with a means of recording the day a pill is dispensed; United States Patent No. 3,344,951 issued to Gervais October 3, 1967 for a dispenser with mechanical means of recording the time the pills are removed; United States Patent No. 3,511,409 issued to Huck on May 12, 1970 describing a mechanical dispenser with a day indicator for pill usage; United States Patent No. 3,687,336 issued to Gayle August 29, 1972 for a mechanical pill dispenser with means of recording the day of dispensing; and United States Patent No. 3,688,945

issued to Harman et. al. on September 5, 1972 disclosing a mechanical contraceptive pill dispenser with time indicator.

Form-fill-seal or blister packaging is widely used in the pharmaceutical and packaging industries in an attempt to increase patient compliance. While such packaging does organize the medication it does not take an active part in either informing the patient of the time to take medication or monitoring the patient's compliance with the medication regimen.

Existing devices in the area of blister packaging and active inventory record keeping include a device described in United States Patent No. 4,616,316 issued to Hanpeter et. al. on October 7, 1986. This device comprises a blister pack, the backing of which contains a matrix of electrically conductive traces, an electronic memory circuit, and a separate microcomputer data processor into which the blister pack is plugged. When a pill is pushed through the blister the trace is broken and the computer registers the event. The disadvantage of this device is the necessity to plug the blister pack into a heavy (estimated 100 gm), bulky external device.

It is therefore desirable to provide a packaging device which is easy to use and capable of monitoring the use of contents.

SUMMARY OF THE INVENTION

The invention uses an electronic chip embedded in a package for monitoring the use of the package contents.

In accordance with an aspect of the present invention, there is provided a packaging device for monitoring use of packaged contents. The packaging device comprises a package, an electrically conducting path and an electronic chip embedded in the package. The package has one or more sealable receptacles for accommodating contents. The electrically conducting path is connectable to each receptacle. It changes its characteristics when the receptacle is opened after being sealed. The electronic chip monitors the change in the characteristics of the conducting path, and generates content use data when the change in the characteristics of the conducting path is detected.

In accordance with another aspect of the present invention, there is also provided a content use monitoring system for monitoring use of contents in a package having at least one sealable receptacle for accommodating contents. The monitoring system comprises an electrically conducting path connectable to a receptacle of the package and capable of changing its characteristics when the receptacle is opened after being sealed, and an electronic chip, embedded in the package, for monitoring the change in the characteristics of the conducting path, and generating content use data when the change in the characteristics of the conducting path is detected.

Other aspects and features of the present invention will be readily apparent to those skilled in the art from a review of the following detailed description of preferred embodiments in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further understood from the following description with reference to the drawings in which:

FIG. 1 is a block diagram showing a content use monitoring system in accordance with an embodiment of the invention;

FIG. 2 is a block diagram showing an example of an electronic chip used in FIG. 1;

FIG. 3 is a schematic view of a content use monitoring system in accordance with another embodiment of the invention;

FIG. 4 is a schematic view of an example of an electronic chip used in FIG. 3; and

FIG. 5 is a schematic cross sectional view of the content use monitoring system of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a packaging device 10 in accordance with an embodiment of the present invention is described. The package device 10 comprises a package 20 and a content use monitoring system 30. The monitoring system 30 comprises an embedded electronic chip (EC) 35 and an electrically conducting path 40 provided on the package 20.

The package 20 defines one or more receptacles 25 to accommodate contents. Each receptacle 25 is sealed after the contents are inserted. Once it is sealed, in order to use the contents, the user needs to break the receptacle 25 to access the contents. The package may be form-fill-seal packaging or blister packaging.

The receptacles 25 may be arranged in any configuration such as rectangular package 20 with multiple rows, single strip, or circular row of receptacles 25. Their configuration is selected depending on the use.

The electrically conducting path 40 is provided to connect between each receptacle 25 and the EC 35. The conducting path 40 may be a wire, metal foil strip, conducting printed (ink) path, or other suitable conducting material. It connects each receptacle 25 to the EC 35 in such a way that removing the contents from the receptacle 25 breaks the path 40, changes the resistance in the circuit or other characteristics in the path 40. The conducting path 40 may form multiple circuits to connect multiple receptacles 25 and the EC 35. The circuits terminate on contact ports or pads of the EC 35.

The EC 35 provides inventory control of the packaged contents. The EC 35 is a small electronic device embedded in the package 20. It may be one of those ECs that are commonly used for financial inventory control in the form of non-contact or contact smart EC cards (Smart Cards). The EC 35 may be embedded in a substrate of the package 20, or provided in one of receptacles 25 or a blister on the package 20.

FIG. 2 shows an example of the EC 35. The EC 35 has a monitor 50, a use data memory 52 and a clock 54. The monitor 50 monitors the change in the characteristics of the conducting path 40. When it detects a change, the monitor 50 generates content use data.

The EC 35 stores the content use data in the use data memory 52. The use data memory 52 is preferably a non-volatile memory. Using the clock 54, the EC 35 may record the content use data including the time when the change of the receptacle 25 is detected. Thus, the opening of receptacle 25 is detected and the use of the contents is monitored.

For example, the monitor 50 may be programmed to record the time each content is removed from the package. It may also be programmed to collect other data such as contents data, and to carry information about the packaged product. The monitor 50 may be programmed to test integrity of each receptacle 25 at intervals and record changes in integrity indicated by changes in the characteristics of the conductive paths 40.

The EC 35 may also have a procedure data memory 56, warning generator 58 and warning device 60. The procedure data memory 56 stores predetermined procedure data regarding how the packaged contents should be used. For example, the procedure data indicates when the contents in each receptacle 25 should be taken, which order the receptacles 25 should be opened, and/or how many receptacles 25 should be opened at a time. The procedure data memory 56 is preferably a non-volatile memory. It is also preferable for some applications that the procedure data memory 56 is a programmable memory.

The warning generator 58 compares the content use data with the procedure data, and generates a warning signal if the content use data indicates incorrect use of the contents in view of the procedure data, e.g., if the user has not accessed the product in the correct sequence, time and/or amount.

In response to the warning signal, the warning device 60 presents a warning to the user. The warning device 60 may be any device which can present a warning to the user, such as light-emitting diodes (LEDs), audible devices, liquid crystal displays (LCDs) or other types of displays, or any combination thereof. The warning may be a simple signal or message. It may be an alert or instructions of further procedures to use the packaging device 10.

Content expiry dates may also be programmed into the procedure data memory 56 and expiration warnings may be provided by the warning device 60.

Reading the content use data stored in the use data memory 52 may be accomplished by using a matched external reader (not shown). As an external reader, a contact type or non-contact communication type may be used.

For reading data by a contact type, the EC 35 may also have an output port 62 so that an external reader may be plugged into the output port 62 and read the content use data.

In addition to or in place of the output port 62, a transmitter 64 may be provided in the EC 35 for transmitting the content use data to an external reader. The transmitter 64 may be a wireless transmitter to communicate with a non-contact type reader, or a wired transmitter to communicate with a contact type reader. For short range communication between the EC 35 and the reader, a low power wireless transmitter may be used. Long range wireless transmission may be used to permit real-time monitoring and communication at distance. This permits real time evaluation of inventory control and feedback to the user if desired.

The output port 62 and transmitter 64 may also be used for programing and reprogramming of the use data memory 52 and/or procedure data memory 56.

As industry standards for ECs are in place for Smart Card applications, similar current or future standards may be followed in the EC 35 of the packaging device 10 to facilitate the use of standard read/write devices and to reduce costs for EC designs. However this invention is not limited to such standardized applications.

Depending on the intended use, the EC can be disposable or reusable. In simple applications, a low power CMOS EC with an internal battery and clock may be suitably used. More complex applications may use higher power ECs such as bipolar, SiGe, or GaAs ECs. These ECs are listed only as examples and other types of ECs may also be used.

FIG. 2 shows the elements described above as separate components. However, one or more elements are provided as a single component or a part of other component in the EC 35. For example, the use data memory 52 and the procedure data memory 56 are shown separately, but a single memory may function as both memories 52, 56. Also, A single controller may have both functions of monitor 50 and warning generator 58.

Also, the elements shown in FIG. 2 are described as being provided in EC 35. However, some elements may be provided in an external reader or other external device. For example, the procedure data memory 56 and warning generator 58 may be provided in an external reader. The

reader may read the content use data through transmitter 64 or port 62 and returns warning data to EC 35 for presentation to the user using warning device 60 on the package device 10. Alternatively, the warning device 60 may be provided in an external reader so that the content use is monitored by another person.

Referring to FIGs. 3 to 5, an example of a packaging device in a form of a blister package 100 is now described. This blister package 100 may be suitably used as a medication package.

As shown in FIG. 3, the blister package 100 has a package backing 102 and a package cover 104 which forms blisters 106. An EC 110 is embedded in the package 100. The system of electrically conductive traces 120 is mounted on the nonconductive backing 102 and connected to the EC 110. The conductive traces 120 are also connected to a common conducting return trace 122.

FIG. 3 shows 12 blisters 106 positioned in two rows but any number of blisters may be accommodated in any other suitable manner. Also, FIG. 3 shows the use of a common return trace 122 but other configurations, such as individual positive and negative traces for each blister, may be used. The position of the EC and the orientation of the blisters are arbitrary.

FIG. 4 shows a detail of EC 110 showing its contact pads 112. The electrically conducting traces 120 in a common return configuration are connected to the EC 110 . Although FIG. 4 shows provision of contact pads 112 for 12 conducting traces 120 to blisters and a common return trace 122, ECs may be designed in any shape or configuration to accommodate any number of traces 120.

FIG. 5 is a cross section showing two blisters 106. Each blister 106 contains a pill 130. The blisters 106 are laminated to the non-conductive backing 102. The blisters 106 are typically formed with a plastic layer 104. Electrically conducting traces 120 are shown attached to the backing and passing below the blisters 106 and the pills 130. Thus, when the user accesses each pill 130, a portion of the backing 102 below the corresponding blister 106 is broken together with the attached conducting trace 120. Thus, the use of pills is monitored by the EC 110.

The package device 100 may be used to determine if patients take their medication as prescribed.

The stored content use data may be used by the user or others. In some cases it may be necessary for the user to return the EC 110 to the dispensary or physician to have their medication use recorded or examined for compliance before another medication package is released. Education may be targeted to poorly compliant patients. Some forms of medication abuse, e.g., taking it all at once to get intoxicated or to sell it on the street, may be detected. The EC 110 may be recycled after its data is read, stored and erased.

The EC 110 may also be connected to a wireless or fixed-wire transmitter or similar device to transmit the package content use data to a pharmacy or other facility in the cases where real-time information on content usage is desirable. Examples of such cases may include clinical drug trials where accurate data must be gathered, where a patient is prescribed potentially toxic pharmaceuticals, or where sequential courses of treatment are packaged and where it is imperative to ensure completion of one phase of treatment before starting the next. Compliance may then be monitored in real time, and warnings may be transmitted back to the patient by wireless if required.

The EC 110 may also record details of batch-sensitive medications such as blood products where recalls might later be required, or to record any information about the use or non-use of the packaged product.

The package device may also permit clinical trials of pharmaceuticals such as analgesics where patients could take the medication as required for symptomatic relief and the time and amounts of medication would later be available to the researchers. This may free clinical trials from interval dosing, which in some cases may not be efficient.

While the above example is described for packaging of pills, the invention is not limited to the packaging of pharmaceuticals or medical products. It is applicable to any items where blister packaging is feasible and where inventory control is desired.

As described above, since the packaging device uses a small EC, it may be made significantly smaller and simpler to use than those described in prior art. It may be manufactured relatively

cheap as ECs are cheaper to produce. Also, it does not require bulky external hookups or attachments for its operation. In its wireless version, no external attachment is required. These features may contribute in increasing of user compliance.

While particular embodiments of the present invention have been shown and described, changes and modifications may be made to such embodiments without departing from the true scope of the invention.

WHAT IS CLAIMED IS:

1. A packaging device for monitoring use of packaged contents, the packaging device comprising:

a package having at least one sealable receptacle for accommodating contents;

an electrically conducting path connectable to the receptacle and capable of hanging its characteristics when the receptacle is opened after being sealed; and

an electronic chip, embedded in the package, for monitoring the change in the characteristics of the conducting path, and generating content use data when the change in the characteristics of the conducting path is detected.

2. The packaging device as claimed in claim 1, wherein the electronic chip has a use data memory for storing the content use data.

3. The packaging device as claimed in claim 2, wherein the electronic chip further has a clock and is programmed to monitor the change in the conducting path continuously to detect the time of the change; and the content use data includes the time of the change.

4. The packaging device as claimed in claim 2, wherein the electronic chip further has a clock and is programmed to monitor the change in the conducting path at intervals, and the content use data includes the time when the change in the conducting path is detected.

5. The packaging device as claimed in claim 1, wherein the electronic chip having an output port for outputting the content use data to an external reader.

6. The packaging device as claimed in claim 1 further comprising a transmitter for receiving the content use data from the electronic chip, and for transmitting the content use data to an external reader.

7. The packaging device as claimed in claim 6, wherein the transmitter is a wireless transmitter capable of carrying out wireless communication with the external reader.

8. The packaging device as claimed in claim 1, wherein the electronic chip has a procedure data memory for storing a predetermined procedure data regarding how to use packaged contents.

9. The packaging device as claimed in claim 8, wherein the package has multiple receptacles, and the predetermined procedure data includes the time, order and/or amount of opening of the receptacles.

10. The packaging device as claimed in claim 8, wherein the electronic chip has a warning generator for generating a warning data based on the content use data and the predetermined procedure data.

11. The packaging device as claimed in claim 10 further comprising a warning device for providing a warning in response to the warning signal.

12. The packaging device as claimed in claim 11, wherein the warning device is provided on the package.

13. The packaging device as claimed in claim 11, wherein the warning device is provided in an external device, and the packaging device further comprises a transmitter for transmitting the warning data to the external device.

14. The packaging device as claimed in claim 8 further comprising:

a transmitter for sending the content use data to an external device, and receiving a warning data from the external device; and

a warning device, provided on the package, for providing a warning in response to the warning signal.

15. The packaging device as claimed in claim 8, wherein the procedure data memory is a programmable memory for allowing a monitor to program the predetermined procedure data.

16. A content use monitoring system for monitoring use of contents in a package having at least one sealable receptacle for accommodating contents, the monitoring system comprising:

an electrically conducting path connectable to a receptacle and capable of changing its characteristics when the receptacle is opened after being sealed; and

an electronic chip, embedded in the package, for monitoring the change in the characteristics of the conducting path, and generating content use data when the change in the characteristics of the conducting path is detected.

17. The content use monitoring system as claimed in claim 16, wherein the electronic chip has a use data memory for storing the content use data.

18. The content use monitoring system as claimed in claim 16 further comprising a transmitter for receiving the content use data from the electronic chip, and for transmitting the content use data to an external reader.

19. The content use monitoring system as claimed in claim 18, wherein the transmitter is a wireless transmitter capable of carrying out wireless communication with the external reader.

20. The content use monitoring system as claimed in claim 16, wherein the electronic chip has a procedure data memory for storing a predetermined procedure data regarding how to use packaged contents.

21. The content use monitoring system as claimed in claim 20, wherein the electronic chip has a warning device for presenting a warning based on the content use data and the predetermined procedure data.

22. A packaged product having a monitoring device for monitoring use of packaged contents, the packaged product comprising:

contents;

a package having at least one sealed receptacle accommodating the contents;

an electrically conducting path connected to the sealed receptacle and capable of changing its characteristics when the receptacle is opened; and

an electronic chip, embedded in the package, for monitoring the change in the characteristics of the conducting path, and generating content use data when the change in the characteristics of the conducting path is detected.

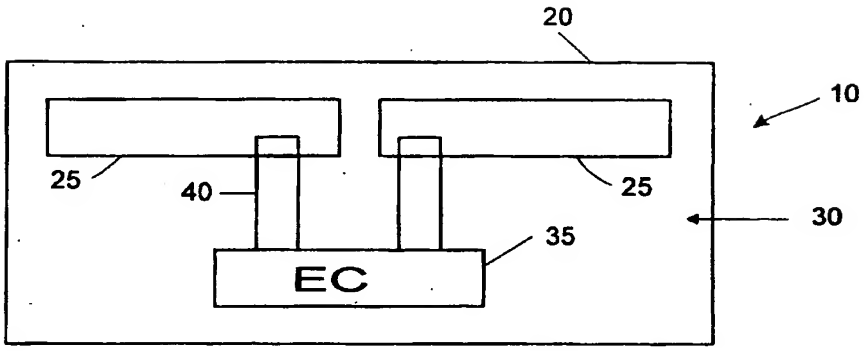

20
10
25
40
25
30
35
EC

FIG. 1

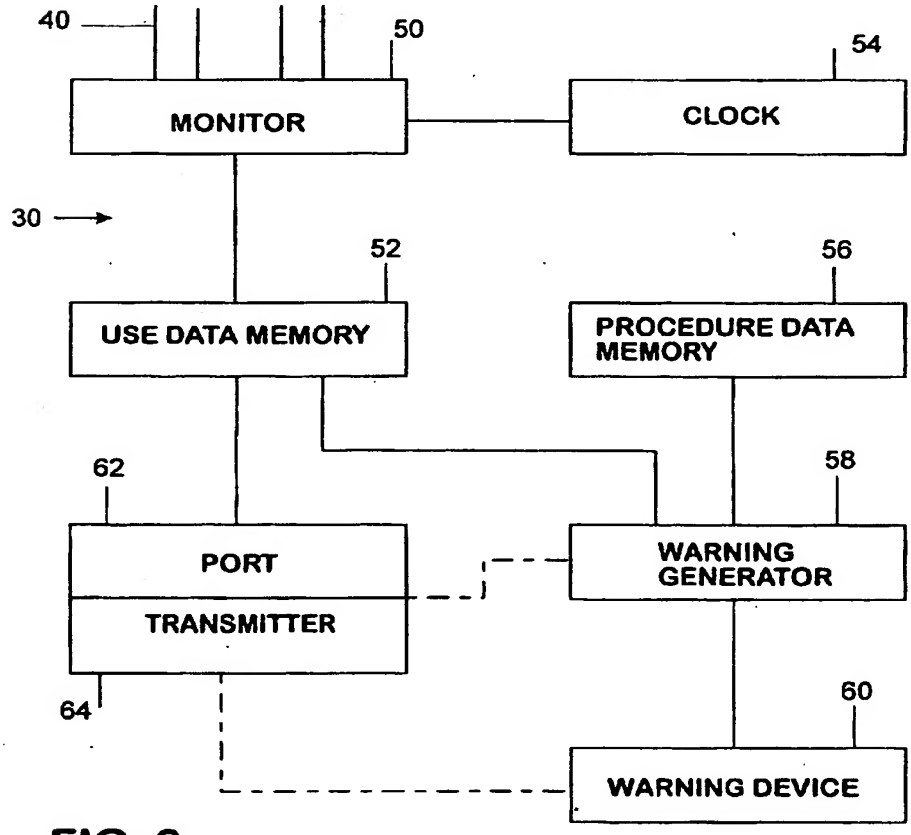

40
50
54
MONITOR
CLOCK
30
52
56
USE DATA MEMORY
PROCEDURE DATA MEMORY
62
58
PORT
TRANSMITTER
WARNING GENERATOR
64
60
WARNING DEVICE

FIG. 2

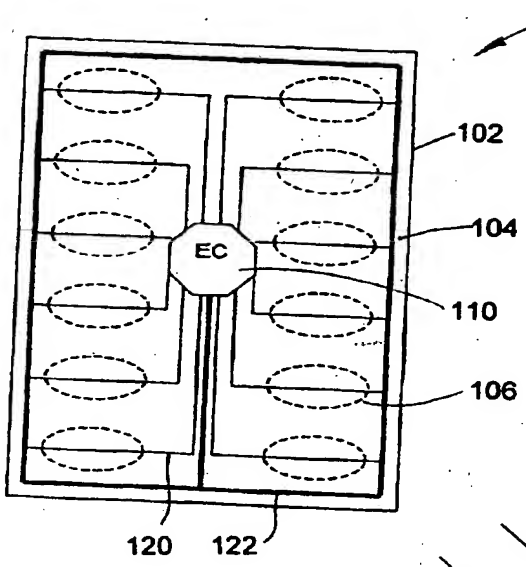


FIG. 3

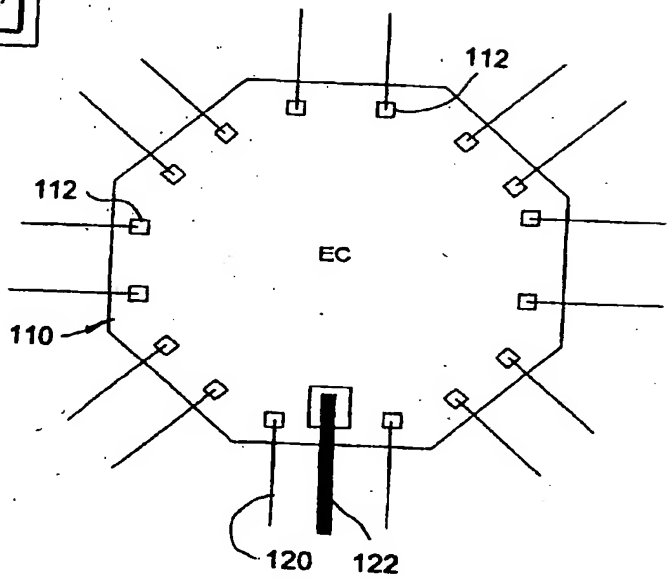


FIG. 4

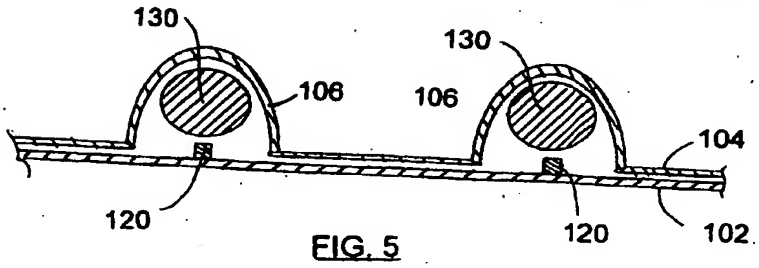


FIG. 5